Complete Summary

GUIDELINE TITLE

Dual-energy x-ray absorptiometry interpretation and reporting in children and adolescents: the 2007 ISCD pediatric official positions.

BIBLIOGRAPHIC SOURCE(S)

Gordon CM, Bachrach LK, Carpenter TO, Crabtree N, El-Hajj Fuleihan G, Kutilek S, Lorenc RS, Tosi LL, Ward KA, Ward LM, Kalkwarf HJ. Dual energy X-ray absorptiometry interpretation and reporting in children and adolescents: the 2007 ISCD Pediatric Official Positions. J Clin Densitom 2008 Jan-Mar;11(1):43-58. PubMed

GUIDELINE STATUS

This is the current release of the guideline.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Diseases and conditions in children and adolescents that make them at risk for skeletal fragility

GUIDELINE CATEGORY

Diagnosis
Evaluation
Risk Assessment
Technology Assessment

CLINICAL SPECIALTY

Endocrinology
Family Practice
Gastroenterology
Pediatrics
Radiology
Rheumatology

INTENDED USERS

Physicians

GUIDELINE OBJECTIVE(S)

To provide recommendations for determining which skeletal sites should be assessed and which adjustments should be made in these assessments, appropriate use of pediatric reference databases, and elements to include in a dual energy X-ray absorptiometry report

TARGET POPULATION

Children and adolescents with conditions that make them at risk for skeletal fragility

INTERVENTIONS AND PRACTICES CONSIDERED

Dual-energy X-ray absorptiometry (DXA)

- Most appropriate and reproducible sites for densitometry in children
- Best method for reporting areal bone mineral density in children; and corrections that should be made for bone size, height, lean body mass, skeletal age, and pubertal stage
- Appropriate use of normative databases in children
- Elements to include in DXA reports for children and adolescents

MAJOR OUTCOMES CONSIDERED

- Accuracy and precision of dual X-ray absorptiometry (DXA) measurements
- Relationship between DXA measurements and future fracture risk and future osteoporosis
- Bone mineral density: Z-score
- Fracture risk and incidence

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Task Force members performed a medical literature search relevant to the clinical or technical questions using a method modified from that utilized by the Cochrane reviews. The literature searches were conducted using electronic databases that included PubMed, EMBASE and MEDLINE.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Quality of Evidence

Good: Evidence includes consistent results from well-designed, well-conducted studies in representative populations.

Fair: Evidence is sufficient to determine effects on outcomes, but the strength of the evidence is limited by the number, quality, or consistency of the individual studies.

Poor: Evidence is insufficient to assess the effects on outcomes because of limited number or power of studies, important flaws in their design or conduct, gaps in the chain of evidence, or lack of information.

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

The development of the International Society for Clinical Densitometry (ISCD) Official Positions was undertaken according to the RAND/UCLA Appropriateness method (RAM). This is a mechanism to determine whether procedures or indications are expected to provide a specific health benefit, designated as "appropriate," that exceeds the potential negative consequences by such a wide margin that the procedure or indication is worth doing, exclusive of cost. The rationale for use of the RAM for the PDC is based on its ability to combine the best available scientific evidence with the collective judgment of worldwide experts in the bone field, to yield appropriate recommendations that are patient- and technology- specific.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Consensus Development Conference)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Position Development Conference (PDC) Expert Panel

Concurrent with Task Force work, international experts in the field of bone densitometry and societies specific to skeletal health were contacted by the PDC Steering Committee to serve as member panelists. Twelve experts agreed to participate on the PDC Expert Panel. In addition to individuals representing many regions of the world, official representatives from The American Society for Bone and Mineral Research (ASBMR), International Society for Bone and Mineral Research (IBMS), and the National Osteoporosis Foundation (NOF) were participants on the Expert Panel. The role of the Expert Panel was to review the proposed Official Positions and supportive documents developed by the task forces and make final recommendations to the International Society for Clinical Densitometry Board of Directors (ISCD BOD).

PDC Moderators

PDC panel Moderators with experience in the RAND/University of California, Los Angeles (UCLA) Appropriateness Method (RAM) were selected by the Steering Committee. Two moderators assisted the Chair of the PDC in the development and refinement of statements derived from the initial Task Forces questions and sub-questions and, alongÂ with the Chair of the PDC, lead the discussion and the rating by the Expert Panel during the PDC in Lansdowne, Virginia, USA, on July 20-22, 2007.

Grading of the Official Positions

All Official Positions for the 2007 PDC were rated by the Expert Panel in the following categories: appropriateness, necessity, quality of evidence, strength of recommendations and application of recommendations (see "Rating Scheme for the Strength of the Recommendations" for definitions).

Proposed ratings in all cases, except the RAM ratings for appropriateness and necessity for each of the above categories, were included in the preliminary Official Positions crafted by each Task Force. Final ratings were determined by the on site, convened Expert Panel that included appropriateness and necessity.

A rating of "appropriate" was required in order for a statement to be sent to the BOD for selection as an ISCD Official Position. Ratings of each Official Position from the 2007 PDC are expressed in the form of four characters representing quality of the evidence, strength of the recommendation, application of the recommendation, and whether it is necessary as previously described. For example, a rating "Good-A-W-Necessary" indicates that the evidence includes consistent results from well-designed, well-conducted studies in representative populations, a strong recommendation supported by the evidence, worldwide recommendation, and is necessary to perform in all instances. Since PDC topics are often selected because strong medical evidence is unavailable, it is the nature of the process that Official Positions are not always supported by the highest possible level of evidence. Nevertheless, the ISCD Official Positions encourage

consistent approaches in the clinical practice of bone densitometry, and focus attention on issues that require further study.

PDC Procedures

After the initial selection of topics by the Board of Directors and Scientific Advisory Committee, the PDC Steering Committee selected five Task Force chairpersons, one for each of the five major PDC topics. Thereafter, the PDC Steering Committee and Task Force chairpersons worked collectively to select international experts as members of their respective Task Forces with the knowledge required to evaluate their assigned PDC topic. All topic questions and sub-questions that were generated by each Task Force were thoroughly researched in the scientific medical literature.

Prior to the PDC meeting in Lansdowne, Virginia, USA, topic questions and sub-questions were converted into recommendation statements that were sent to the Expert Panel for an initial "appropriateness" rating. The PDC required a median "appropriateness" rating in either the upper third or lower third of the rating continuum (continuum was 1 to 9 with clusters 7 to 9 representing the upper third and clusters 1 to 3 representing the lower third) without "disagreement." "Disagreement" was defined as lack of consensus being predetermined to be four or more Expert Panelists rating in extreme clusters 1 to 3 and 7 to 9. In circumstances where the median "appropriateness" rating was less than 7, no Official Position was developed.

In making its decisions, the Expert Panel considered the level of the medical evidence, expert opinion and the clinical need for a recommendation. In some instances, regulatory issues received consideration. The statements rated as "appropriate" with a median score of 7 or higher without "disagreement" by the Expert Panel were designated Official Positions. The statements rated as "uncertain" with a median score between four and six or any median score with "disagreement" were further discussed at the PDC. After the initial rating the documents supporting all Task Forces' recommendations were sent to the Expert Panelists for review. In brief, Task Force chairs presented reports on their topics supporting the "uncertain" statements to the Expert Panelists in closed session on the first day of the conference. These statements were then edited by Task Force chairs, if necessary, reflecting suggestions made by the Expert Panelists. Re-rating of "uncertain" statements occurred during each Task Force chairpersons' presentation when the PDC Moderators felt there was a significant likelihood of change in the opinions of the Expert Panel.

After all statements rated as "appropriate without disagreement" had been selected and all supporting evidence presented, the Expert Panel performed a final rating for necessity, quality of the evidence, strength of the recommendation, and application of the recommendation. The following day, the proposed Official Positions with supportive evidence were presented by the Task Force chairs at a meeting open to the public and attended by ISCD members, representatives from companies with interests in bone health and skeletal assessment, and other individuals with interest in bone disease and densitometry. All participants were encouraged to provide comments and suggestions to the expert panelists. On the third day, the Expert Panelists, in closed session, determined final wording of the proposed Official Positions.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

All Official Positions for the 2007 Position Development Conference were rated by the Expert Panel in the following categories:

1. **Appropriateness**: Statements that the Expert Panel rated as "appropriate without disagreement" according to predefined criteria derived from the RAND/University of California, Los Angeles (UCLA) Appropriateness Method (RAM) were referred to the International Society for Clinical Densitometry Board of Directors (ISCD BOD) with a recommendation to become ISCD Official Positions. A statement was defined as "appropriate" when the expected health benefit exceeded the expected negative consequences by a significant margin such that it was worth performing.
2. **Necessity**: Recommended Official Positions that were rated by the Expert Panel were then rated according to necessity to perform in all circumstances, i.e., whether the health benefits outweighed the risks to such an extent that it must be offered to all patients. Necessity rating was conducted in a similar fashion as the appropriateness rating, in that each Official Position had to be rated as necessary without disagreement using similar predefined RAM criteria.
3. **Quality of evidence**:

   Good: Evidence includes consistent results from well-designed, well-conducted studies in representative populations.

   Fair: Evidence is sufficient to determine effects on outcomes, but the strength of the evidence is limited by the number, quality, or consistency of the individual studies.

   Poor: Evidence is insufficient to assess the effects on outcomes because of limited number or power of studies, important flaws in their design or conduct, gaps in the chain of evidence, or lack of information.

4. **Strength of recommendations**:

   A. Strong recommendation supported by the evidence

   B. Recommendation supported by the evidence

   C. Recommendation supported primarily by expert opinion

5. **Application of recommendations**:

   W: Worldwide recommendation

   L: Application of recommendation may vary according to local requirements

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The proposed Official Positions with supportive evidence were presented by the Task Force chairs at a meeting open to the public and attended by International Society for Clinical Densitometry (ISCD) members, representatives from companies with interests in bone health and skeletal assessment, and other individuals with interest in bone disease and densitometry. All participants were encouraged to provide comments and suggestions to the expert panelists. On the second day, the Expert Panelists, in closed session, determined final wording of the proposed Official Positions.

Following completion of the Position Development Conference, the Steering Committee finalized recommendation wording without changing content. These recommendations were then presented to the International Society for Clinical Densitometry Board of Directors (ISCD BOD) for review and voting. The BOD did not alter the content or wording of the proposed Official Positions. Recommendations approved by a majority vote of the ISCD BOD became ISCD Official Positions.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Note from the National Guideline Clearinghouse (NGC) and the International Society for Clinical Densitometry (ISCD): The full list of positions from the ISCD is provided in '2007 Official Positions & Pediatric Official Positions' (see the "Availability of Companion Documents" field).

Definitions for the quality of evidence (good, fair, poor), strength of recommendations (A-C), application of recommendations (W, L), and appropriateness/necessity are presented at the end of the "Major Recommendations" field.

What Are the Most Appropriate and Reproducible Sites for Densitometry in Children?

International Society for Clinical Densitometry (ISCD) Official Positions

- Dual-energy X-ray absorptiometry (DXA) is the preferred method for assessing bone mineral content (BMC) and areal bone mineral density (BMD).

  Grade: Good-B-W-Necessary

- The posterior-anterior (PA) spine and total body less head (TBLH) are the most accurate and reproducible skeletal sites for performing BMC and areal BMD measurements.

  Grade: Good-B-W-Necessary

- Soft tissue measures in conjunction with whole body scans may be helpful in evaluating patients with chronic conditions associated with malnutrition, such as anorexia nervosa, inflammatory bowel disease, cystic fibrosis, or with both muscle and skeletal deficits, such as idiopathic juvenile osteoporosis.

  Grade: Fair-B-W-Necessary

- The hip (including total hip and proximal femur) is not a reliable site for measurement in growing children due to significant variability in skeletal development and lack of reproducible regions of interest.

  Grade: Fair-B-W-Necessary

What Is the Best Method for Reporting Areal BMD in Children; What Corrections Should be Made for Bone Size, Height, Lean Body Mass, Skeletal Age, or Pubertal Stage?

ISCD Official Positions

- In children with linear growth or maturational delay, spine and TBLH BMC and areal BMD results should be adjusted for absolute height or height age, or compared to pediatric reference data that provide age-, gender- and height-specific Z-scores.

  Grade: Good-A-W-Necessary

What Are the Most Appropriate Normative Databases for Use in Childhood?

ISCD Official Positions

- An appropriate reference data set must include a sample of the general healthy population sufficiently large to characterize the normal variability in bone measures that takes into consideration gender, age and race/ethnicity.

  Grade: Good-A-W-Necessary

- When upgrading densitometer instrumentation or software, it is essential to use reference data valid for the hardware and software technological updates.

  Grade: Good-A-W-Necessary

What Are the Elements That Should Be Included in a DXA Report for a Child or Adolescent?

ISCD Official Positions

Baseline DXA Testing

- Baseline DXA reports should contain the following information:
    - DXA manufacturer, model and software version
    - Referring physician
    - Patient age, gender, race/ethnicity, weight and height
    - Relevant medical history including previous fractures
    - Indication for study
    - Bone age results, if available
    - Technical quality
    - BMC and areal BMD
    - BMC and areal BMD Z-score
    - Source of reference data for Z-score calculations
    - Adjustments made for growth and maturation
    - Interpretation
    - Recommendations for the necessity and timing of the next DXA study are optional

  Grade: Good-C-W-Necessary

Serial DXA Testing

- Accurate interpretation of serial DXA results requires knowledge of the least significant change (LSC) for all sites measured and for all technologists at the DXA testing facility.

  Grade: Good-A-W-Necessary

- Should be done only when the expected change in areal BMD equals or exceeds the least significant change.

  Grade: Fair-B-W-Necessary

- Serial DXA reports should include the same information as for baseline testing, but additionally include:
    - Indications for follow-up scan
    - Comparability of studies
    - Interval changes in height, weight
    - BMC and areal BMD Z-scores adjusted or unadjusted for height or other adjustments
    - Percent change in BMC and areal BMD, and interval change in Z-scores
    - Recommendations for the necessity and timing of the next DXA study are optional

  Fair-C-W-Necessary

Terminology

- T-scores should not appear in pediatric DXA reports

Grade: Good-C-W-Necessary

- The term "osteopenia" should not appear in pediatric DXA reports

  Grade: Good-A-W-Necessary

- The term "osteoporosis" should not appear in pediatric DXA reports without knowledge of clinically significant fracture history.

  Grade: Good-A-W-Necessary

- "Low bone mineral content or bone mineral density for chronologic age" is the preferred term when BMC or areal BMD Z-score are less than or equal to -2.0.

  Grade: Fair-C-W-Necessary

Definitions:

All Official Positions for the 2007 Position Development Conference were rated by the Expert Panel in the following categories:

1. **Appropriateness**: Statements that the Expert Panel rated as "appropriate without disagreement" according to predefined criteria derived from the RAND/University of California, Los Angeles (UCLA) Appropriateness Method (RAM) were referred to the International Society for Clinical Densitometry Board of Directors (ISCD BOD) with a recommendation to become ISCD Official Positions. A statement was defined as "appropriate" when the expected health benefit exceeded the expected negative consequences by a significant margin such that it was worth performing.
2. **Necessity**: Recommended Official Positions that were rated by the Expert Panel were then rated according to necessity to perform in all circumstances, i.e., whether the health benefits outweighed the risks to such an extent that it must be offered to all patients. Necessity rating was conducted in a similar fashion as the appropriateness rating, in that each Official Position had to be rated as necessary without disagreement using similar predefined RAM criteria.
3. **Quality of evidence**:

   Good: Evidence includes consistent results from well-designed, well-conducted studies in representative populations.

   Fair: Evidence is sufficient to determine effects on outcomes, but the strength of the evidence is limited by the number, quality, or consistency of the individual studies.

   Poor: Evidence is insufficient to assess the effects on outcomes because of limited number or power of studies, important flaws in their design or conduct, gaps in the chain of evidence, or lack of information.

4. **Strength of recommendations**:

A. Â Strong recommendation supported by the evidence

B. Â Recommendation supported by the evidence

C. Â Recommendation supported primarily by expert opinion

5. **Application of recommendations**:

   W: Worldwide recommendation

   L: Application of recommendation may vary according to local requirements

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of evidence supporting the recommendations is specifically stated for each recommendation (see "Major Recommendations" field).

Since the field of bone densitometry is new and evolving, some clinically important issues that are addressed at the Position Development Conferences are not associated with robust medical evidence. Accordingly, some Official Positions are based largely on expert opinion.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Appropriate determination of skeletal sites that should be assessed in children and adolescents and adjustments that should be made in these assessments
- Appropriate use of pediatric reference databases
- Appropriate documentation of dual energy X-ray absorptiometry reports for children and adolescents

POTENTIAL HARMS

False positive results leading to the over-diagnoses of skeletal deficits

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

Since Position Development Conference topics are often selected because strong medical evidence is unavailable, it is the nature of the process that Official Positions are not always supported by the highest possible level of evidence.

Nevertheless, theÂ International Society for Clinical Densitometry (ISCD) Official Positions encourage consistent approaches in the clinical practice of bone densitometry, and focus attention on issues that require further study.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy included publication of the International Society for Clinical Densitometry (ISCD) Official Positions in international journals that directly or indirectly pertain to skeletal diseases and the measurement of skeletal health.

Formal presentation of the ISCD Official Positions occurs at ISCD Annual Scientific Meetings, all ISCD Adult and Pediatric Bone Density Educational Courses, and ISCD Vertebral Fracture Assessment Educational courses. The Official Positions have been published in the society's official journal, Journal of Clinical Densitometry and Assessment of Skeletal Health.

IMPLEMENTATION TOOLS

Quick Reference Guides/Physician Guides

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness
Staying Healthy

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Gordon CM, Bachrach LK, Carpenter TO, Crabtree N, El-Hajj Fuleihan G, Kutilek S, Lorenc RS, Tosi LL, Ward KA, Ward LM, Kalkwarf HJ. Dual energy X-ray absorptiometry interpretation and reporting in children and adolescents: the 2007 ISCD Pediatric Official Positions. J Clin Densitom 2008 Jan-Mar;11(1):43-58. PubMed

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2008 Mar

GUIDELINE DEVELOPER(S)

International Society for Clinical Densitometry - Private Nonprofit Organization

SOURCE(S) OF FUNDING

International Society for Clinical Densitometry

GUIDELINE COMMITTEE

Dual Energy X-ray Absorptiometry Interpretation and Reporting in Children and Adolescents Task Force

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Task Force Members: Catherine M. Gordon (*Chair*), Divisions of Endocrinology and Adolescent Medicine, Children's Hospital Boston, Boston, MA, USA; Laura K. Bachrach, Stanford University, Palo Alto, CA, USA; Thomas O. Carpenter, Yale University, New Haven, CT, USA; Nicola Crabtree, Queen Elizabeth Hospital, Birmingham, UK; Ghada El-Hajj Fuleihan, American University of Beirut, Beirut, Lebanon; Stepan Kutilek, Center for Clinical and Basic Research-Synarc, Pardubice, Czech Republic; Roman S. Lorenc, Children's Memorial Health Institute, Warsaw, Poland; Laura L. Tosi, Children's National Medical Center, Washington, DC, USA; Katherine A. Ward, University of Manchester, Manchester, UK; Leanne M. Ward, University of Ottawa, Ottawa, Canada

Liaison: Heidi J. Kalkwarf, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The 2007 Pediatric Position Development Conference (PDC) received no grants from any commercial supporters. Commercial support had no role in the selection of Pediatric PDC participants, or ratings for the final International Society for Clinical Densitometry (ISCD) Official Positions.

ENDORSER(S)

American Association of Clinical Endocrinologists - Medical Specialty Society
American Society for Bone and Mineral Research - Professional Association
National Osteoporosis Foundation - Disease Specific Society
The Endocrine Society - Disease Specific Society
The North American Menopause Society - Private Nonprofit Organization

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available from the Journal of Clinical Densitometry.

Print copies: Available from the International Society for Clinical Densitometry, 342 North Main St., West Hartford, CT 06117-2507; Phone: (860) 586-7563; Fax: (860) 586-7550; Website: www.iscd.org.

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- 2007 official positions of the International Society for Clinical Densitometry. 2007 Oct. 14 p. Electronic copies: Available in Portable Document Format (PDF) from the International Society for Clinical Densitometry Web site.
- 2007 official positions & pediatric official positions of the International Society for Clinical Densitometry. 2007 Oct. 17 p. Electronic copies: Available in Portable Document Format (PDF) from the International Society for Clinical Densitometry Web site.
- Official positions of the International Society for Clinical Densitometry and executive summary of the 2007 ISCD Position Development Conference. 2008. 17 p. Electronic copies: Available in Portable Document Format (PDF) from the International Society for Clinical Densitometry Web site.

Print copies: Available from the International Society for Clinical Densitometry, 342 North Main St., West Hartford, CT 06117-2507; Phone: (860) 586-7563; Fax: (860) 586-7550; Website: www.iscd.org.

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI Institute on July 27, 2009. The information was verified by the guideline developer on September 15, 2009.

COPYRIGHT STATEMENT

Date Modified: 1/4/2010